

COLD GAS SPRAYING

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Overview

Cold spraying is a relatively new coating process by which coatings can be produced without significant heating of the sprayed powder. The powder particles are accelerated in a de-Laval-type nozzle with gas of moderate temperature to velocities of more than 500 m/s. Upon impact they form a dense and well adherent coating. Compared to thermal spray processes like arc, flame, and plasma spraying, oxidation of the spray material and the substrate can almost be avoided. Cold spraying can also be used to create coatings up to several centimeters thickness as well as free standing structures. This opens a wide field of new applications.

The institute built its own cold spraying system with the technical support from Linde Gas AG. At this facility, researchers study the material science and fluid dynamic aspects of the cold spray process. In addition, the actual application of this new technique in industry is investigated. Lastly, prototype nozzles are produced and tests are carried out to determine their performance.

The activities involve collaborations with Linde Gas AG, CGT as a manufacturer of cold spray systems, Professor H. J. Richter from Dartmouth College, Hanover, NH, USA, and the Institute of Materials Physics at the University of Goettingen.

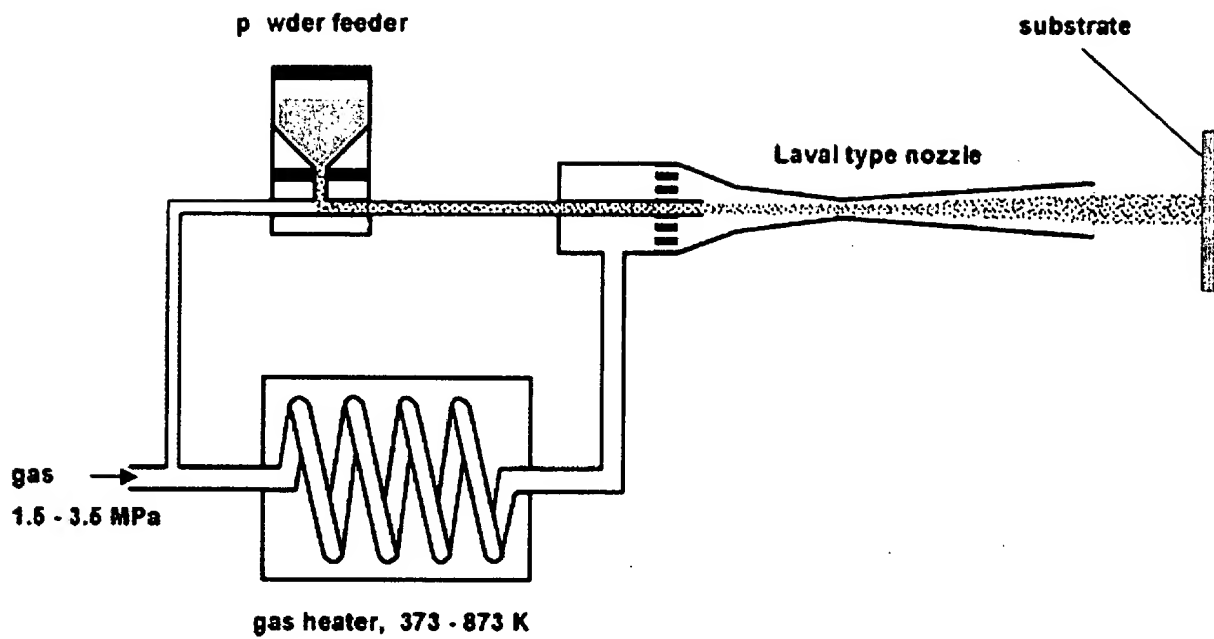
Research Topics

- Coating development, spraying, and characterization of coatings
- Investigation of the bonding mechanism in cold spraying by high resolution transmission electron microscopy
- Process development in cooperation with Linde Gas AG and CGT as a manufacturer of cold spray systems
- Modeling of the gas-particle flow by computational fluid dynamics methods and development of nozzles for cold spraying



Examples

Principle of Cold Gas Spraying

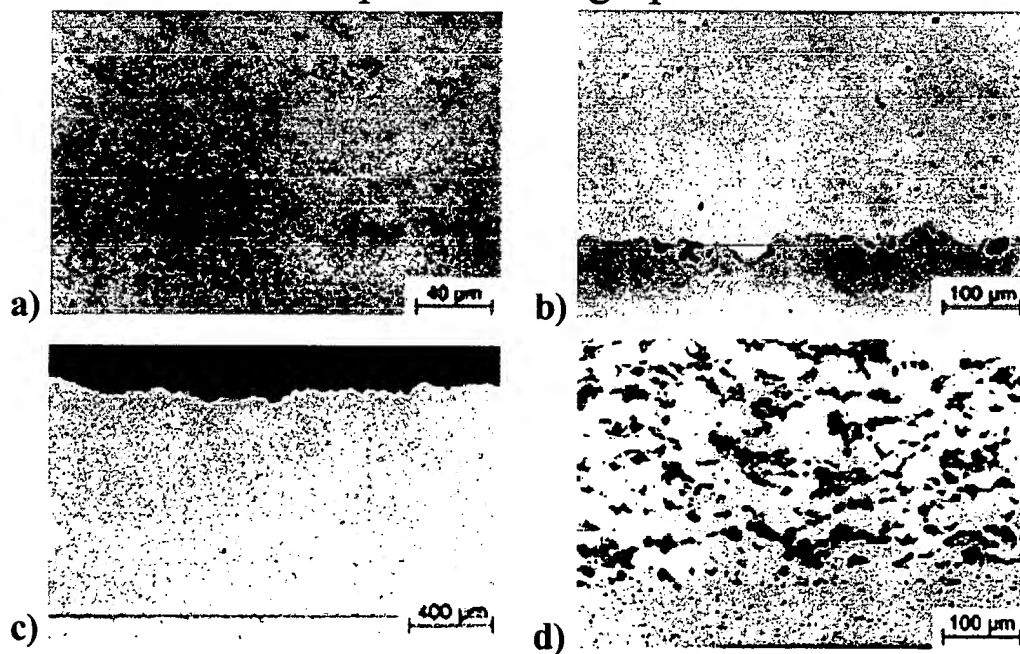


Cold Gas Facility (click on pics to enlarge)



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Optical micrographs



Cross section of **a)** cold sprayed zinc coating on aluminum substrate, as-polished **b)** 316L coating on carbon steel substrate, as-polished **c)** copper coating and **d)** Al-Ti composite coating on aluminum substrate, as-polished

Published Works

Cold Spraying - A Study of Process and Coating Characteristics.

H. Kreye, T. Stoltenhoff: Proc. of the 1st Intern. Thermal Spray Conf., ASM International USA, Montreal, Canada, 2000, p. 419-422.

Cold Spraying - from Thermal Spraying to High Kinetic Energy Spraying.

T. Stoltenhoff, H. Kreye, W. Kroemmer, H.J. Richter: Proc. 5th HVOF Colloquium, Erding, 2000, GTS Ed., p 29-38.



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Cold Gas Spraying Facility at the University of the Federal Armed Forces, Hamburg



**Cold Gas Spray Pistol with Completed Copper
Coatings**

